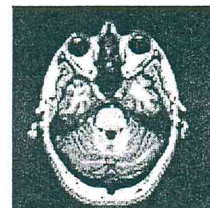




## Civil Air Patrol's ACE Program

### NASA Spinoffs Grade 4 Aerospace Lesson #8



**Topic:** technology (science, social studies, language arts)

**Lesson Reference:** NASA Explores

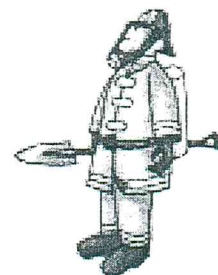
**Length of Lesson:** 30 minutes

#### Objectives:

- Students will make predictions.
- Students will define NASA spinoffs.
- Students will identify NASA spinoffs.
- Students will evaluate the importance of NASA spinoffs.

#### National Science Standards:

- Content Standard A: Science as Inquiry
  - Abilities necessary to do scientific inquiry
- Content Standard E: Science and Technology
  - Abilities of technological design
  - Understandings about science and technology
- Content Standard G: History and Nature of Science
  - Science as a human endeavor



#### Background Information: (from NASA Explores)

Dental braces, rechargeable batteries, cordless power tools, and cardiac monitoring equipment—every day, we use products and services that originated from space technologies. We have better means of detecting and treating cancer and cardiovascular disease because of our space programs. Space programs also taught us about the large ozone hole in our atmosphere, the hazards of solar radiation, the path of killer hurricanes, and how to more effectively manage crops and our national forests. If not for America's continued investment in space exploration, we wouldn't have wireless telephones, satellite television, or global positioning systems. Our technology has even been used to help law enforcement put criminals behind bars and to protect firefighters. The technologies that led to the computer bar codes in retail stores, the quartz watch you are wearing, and household smoke detectors that help you sleep soundly at night were originally developed for NASA.

The benefits of aerospace technology to mankind are becoming more and more commonplace thanks to scientists involved in the space program, and to private companies that transfer aeronautics and space technology into products and services for everyday living. When aerospace technology is adapted for commercial use, it is called technology transfer (spinoffs). NASA investments in space have yielded more than 1,200 spin-offs used to enrich lives on Earth every day. Each year three-technology transfers are inducted into the U.S. Space Foundation's Technology Hall of Fame.

Through exploring space, we improve our lives, boost our economy, inspire future generations, and lift our national spirit—all this for less than one percent of the Federal budget!

In this lesson, students will predict which items are NASA spinoffs, and then they will learn the correct answers to their predictions.

**Materials:**

- dry erase board with marker (or chalkboard and chalk)
- "More NASA Spinoffs" copy for each student (copy included)
- "Why Space? - Crossword Puzzle" (optional)

**NOTE:** You may choose to allow students to discover not only the meaning of NASA spinoff, but also information about spinoffs by substituting the enrichment activities for the lesson presentation below. (Also, please note that Tang and Velcro are NOT NASA spinoffs.)

**Lesson Presentation:**

1. Ask students if they have ever thought about the importance of space exploration. Should we try to visit other moons and planets? Is it worth spending millions and billions of dollars to send people, spacecrafts, satellites, and space stations into space? After all, we have many things here on Earth that need our attention and money. Allow students to share their thoughts.
2. Write the term "NASA spinoff" on the board. Ask students if anyone knows what the term "NASA spinoff" means.
3. Explain that a NASA spinoff is a device or piece of technology that was originally created for or by NASA, but is now used by many people around the world in some way or another. According to NASA (<http://www.sti.nasa.gov/tto/spinfaq.htm#spinfaq6>), "a spinoff is a commercialized product that incorporates NASA technology or NASA 'know how' and benefits the public, while a NASA success is a NASA technology that is not available on the market but still yields benefits to the public. For example, a NASA technology that was used to restore valuable artwork that was damaged in a fire is considered a 'success' because it is not available for sale on the commercial market."



4. Provide students with the example of temper foam that they may have seen advertised on TV. Originally, the development of this memory foam was under NASA contract with the goal of improving airplane cushions and providing better crash protection for those onboard a plane. Today, it is used in many mattresses and pillows! Tell students that they will see how many spinoffs they can identify.
5. Distribute the "More NASA Spinoffs" sheet to each student. Have them circle all of the items that they think are NASA spinoffs.
6. Once students have finished indicating their predictions by circling the items they think are NASA spinoffs, go over the information for each item. Have students keep a tally of the number they missed at the top of their page.
7. Discuss the results. Which student made the most correct predictions? Ask students to explain which spinoffs surprised them. Ask students to explain which spinoffs they think are best.

#### **Summarization:**

Ask a student to explain what a NASA spinoff is. Ask students how today's lesson affected their opinion of whether or not space exploration is important. Tell students that the spinoffs they learned about today are just a few of the many NASA spinoffs.

Character Connection: Remind students that we enjoy many conveniences and better health today because people were curious and wanted to improve living and working conditions for others. Encourage students to always look for ways to help others.

#### **Assessment:**

- teacher observation
- completed "More NASA Spinoffs" sheet
- "Why Space? - Crossword Puzzle" and/or "NASA Spinoffs" enrichment worksheets (optional)

#### **Additional activity ideas to enrich and extend the primary lesson (optional):**

- Allow students to play the spin-off game found at:  
<http://spaceplace.nasa.gov/en/kids/spinoffs.shtml> (You must have a browser that supports Java to play the Spinoffs Memory Game.)
- Have students complete the "Why Space? - Crossword Puzzle" that can be used with the <http://spaceplace.nasa.gov/en/kids/spinoffs.shtml> site.
- Have students complete the "NASA Spinoffs" worksheet.
- With a specific list of NASA spinoffs from which to choose, students can vote on which one they feel is the best. With the data, help students create a bar graph or pie chart that illustrates which NASA spinoff students think is the best (or most important).
- Have students play a NASA spinoff game at  
[http://www.nasa.gov/audience/forkids/kidsclub/flash/games/levelfour/KC\\_Spinoffs\\_Hidden\\_Pictures.html](http://www.nasa.gov/audience/forkids/kidsclub/flash/games/levelfour/KC_Spinoffs_Hidden_Pictures.html)

## More NASA Spinoffs

Name \_\_\_\_\_

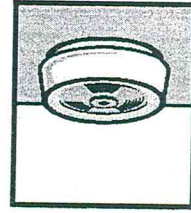
Look at each picture. Circle the pictures that show a NASA spinoff.



Bicycle Helmets



Cordless Vacuums



Smoke Detectors



Joysticks



Foam Gliders



Pool Cleaners



Wheelchairs



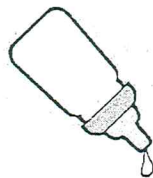
Swimsuits



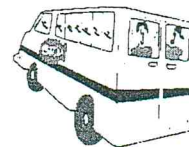
Golf Balls



Sun Glasses



Baby Formula



School Buses

Source: NASA Explores

CAP's ACE Program (2010)

## "More NASA Spin Offs" ANSWERS:

### **Bicycle Helmets**

Yes! Who would have thought? Technology used to cut drag on the wings of planes can be used to make riders safer. Old bike helmets were ugly. They made your head hot. The new helmets don't weigh as much. They have air vents in the front and back. This pulls cool air into the helmet and moves it around the biker's head.

### **Cordless Vacuums**

Yes! Astronauts needed tools that were small. The tools needed to be light and they needed to run on batteries. "NASA did not invent cordless power tools, however. The first cordless power tool was unveiled by Black & Decker in 1961. In the mid-1960's, Martin Marietta Corporation contracted with Black & Decker to design tools for NASA. As a result of their work, Black & Decker created several spin-offs, including a cordless miniature vacuum cleaner called the Dustbuster."

(<http://www.sti.nasa.gov/tto/spinfaq.htm#spinfaq10>)

### **Smoke Detectors**

Yes, but NASA did not invent the smoke detector. "NASA did not invent the smoke detector. NASA's connection to the modern smoke detector is that it made one with adjustable sensitivity as part of the Skylab project. Honeywell made the device commercially available. The consumer could use it to avoid 'nuisance' alarms while cooking."

(<http://www.sti.nasa.gov/tto/spinfaq.htm#spinfaq11>)

### **Joysticks**

Yes! Joysticks help people play their best game. Astronauts used them to practice things like runway landings.

### **Foam Gliders**

Yes! Toy designers at Hasbro wanted to make a foam glider that a child could fly. At first, their gliders didn't fly so well. They asked NASA for help. The engineers gave them a few science lessons. This helped them make a better glider.

### **Pool Cleaners**

Yes! This space technology was made to clean water on long flights. It can be used in swimming pools to clean the water.

### **Wheelchairs**

Yes! Robot technology was used to help make chairs move. The wheelchair can respond to 35 words.



### **Swimsuits**

Yes! Swimmers can wear a suit that makes them faster swimmers! Very small grooves were put on the outside of planes to make them go through the air faster. The grooves were put in swimsuits, too. They help the swimmer move through the water faster.

### **Golf Balls**

Yes! Space Shuttle technology was used to make golf balls go farther.

### **Sunglasses**

Yes! The sunglasses protect your eyes. They let good light in and keep bad light out! They don't scratch or break like other lenses. This helps them last longer, too.

### **Baby Formula**

Yes! NASA made an oil to help astronauts on long space flights. This oil can be added to baby formula, too. It helps their brains and eyes grow better.

### **School Buses**

Yes! The ride to school and back home is smoother and safer because of NASA technology. A stronger and safer bus frame was made. NASA testing was used to see how the frame would hold up, too.

**NOTE:** (from NASA at <http://www.sti.nasa.gov/tto/spinfaq.htm>)

Are Tang, Teflon, and Velcro NASA spinoffs?

Tang, Teflon, and Velcro, are not spinoffs of the Space Program. General Foods developed Tang in 1957, and it has been on supermarket shelves since 1959. In 1962, when astronaut John Glenn performed eating experiments in orbit, Tang was selected for the menu, launching the powdered drink's heightened public awareness. NASA also raised the celebrity status of Teflon, a material invented for DuPont in 1938, when the Agency applied it to heat shields, space suits, and cargo hold liners. Velcro was used during the Apollo missions to anchor equipment for astronauts' convenience in zero gravity situations. Although it is a Swiss invention from the 1940s, it has since been associated with the Space Program.



NAME \_\_\_\_\_



What is a NASA spin-off? \_\_\_\_\_



Name 5 NASA spin-offs. 1. \_\_\_\_\_ 2. \_\_\_\_\_



3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_



What do you think is the least important spin-off? \_\_\_\_\_



What do you think is the best NASA spin-off? \_\_\_\_\_

Write a paragraph that explains your choice for the best spin-off. Why do you think it is the best?

